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(54) Oscillation circuit and oscillation method

Oszillatorschaltung und -verfahren

Circuit d'oscillation et procédé d'oscillation

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(73) Proprietor: **SONY CORPORATION**
Tokyo (JP)

(72) Inventors:
- **Imai, Tadashi**
  Shinagawa-ku, Tokyo (JP)
- **Kobayashi, Kozo**
  Shinagawa-ku, Tokyo (JP)

(74) Representative: **Ayers, Martyn Lewis Stanley**
J.A. KEMP & CO.,
14 South Square,
Gray's Inn
London WC1R 5JJ (GB)

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Description

[0001] The present invention relates to an oscillation circuit and an oscillation method and, more particularly, to an oscillation circuit and an oscillation method in which signals having a high frequency can be generated without adjustments.

[0002] Fig. 3 shows an example of the construction of an oscillation circuit. In this example, the emitter of an NPN transistor 3 is grounded via a resistor 4, and a capacitor 6 is connected in parallel to the resistor 4. Further, a capacitor 5 is connected between the base and the emitter of the NPN transistor 3. A resistor 1 and a resistor 2 are connected between a terminal T_3 which is connected to a predetermined voltage source and the ground, with the connection point of the resistor 1 and the resistor 2 being connected to the base of the NPN transistor 3. Each of these resistors 1, 2 and 4 supplies a predetermined bias voltage to the NPN transistor 3.

[0003] Further, connected to the base of the NPN transistor 3 is a one-port-type SAW (Surface Acoustic Wave) resonator 9 via a capacitor 7 for blocking the flow of direct current. In addition, a terminal T_3 is grounded via a capacitor 8.

[0004] The one-port-type SAW resonator 9 is formed as shown in, for example, Fig. 4, and the equivalent circuit thereof is formed as shown in Fig. 5.

[0005] More specifically, a parallel circuit of (i) a series circuit formed of a resistor 21, a coil 22 and a capacitor 23 and (ii) a capacitor 24 is connected between terminals T_1 and T_2. This capacitor 24 is a terminal-to-terminal capacitance of the one-port-type SAW resonator 9.

[0006] This one-port-type SAW resonator 9 substantially functions as an inductance when the conditions described below are satisfied, where L_{22}, C_{23}, C_{24} and R_{21} are the inductance of the coil 22, the capacitance of the capacitor 23, the capacitance of the capacitor 24 and the resistance value of the resistor 21, respectively:

$$\omega L_{22} > 1/(\omega C_{23}) = 1/(\omega C_{24}) = R_{21}$$

[0007] That is, when the one-port-type SAW resonator 9 satisfies the above-described conditions and substantially functions as an inductance (coil), the circuit of Fig. 3 forms a what is commonly called Colpitts oscillation circuit and performs an oscillation operation.

[0008] In the oscillation circuit shown in Fig. 3, a two-port-type SAW resonator 43 shown in Figs. 7 and 8 to be described later may be used instead of the one-port-type SAW resonator 9 shown in Figs. 4 and 5.

[0009] Fig. 6 shows an example of the construction of another oscillation circuit. In this example, the output of an amplifier 41 is fed to the two-port-type SAW resonator 43 via a capacitor 42. Further, the output of the two-port-type SAW resonator 43 is input to the amplifier 41 via a capacitor 44.

[0010] The amplifier 41 is contained in an IC, and the inductance components, such as a bonding wire present between each terminal of the IC and the built-in chip, form a coil 45.

[0011] The two-port-type SAW resonator 43 has terminals T_{11} and T_{12} for input/output purposes and terminal T_{13} for grounding purposes, as shown in, for example, Fig. 7. Fig. 8 shows an equivalent circuit of such two-port-type SAW resonator 43.

[0012] That is, the terminal T_{11} is connected to one of the terminals of one of the windings of an equivalent transformer 55 via a resistor 52, a coil 53 and a capacitor 54. The other terminal of this winding of the equivalent transformer 55 is connected to the terminal T_{13}. The terminal T_{11} is connected to the terminal T_{13} via a capacitor 51.

[0013] The terminal T_{12} is connected to the terminal T_{13} via a parallel circuit of the other winding of the equivalent transformer 55 and a capacitor 56.

[0014] The two-port-type SAW resonator 43 substantially functions as a delay phase circuit and is formed to be able to select delay phase signals of 0 and 180 degrees mainly by the coil 53 and the equivalent transformer 55.

[0015] Therefore, the output of the amplifier 41 is input to the two-port-type SAW resonator 43 via the capacitor 42, and a signal whose phase is delayed 0 or 180 degrees is input from the two-port-type SAW resonator 43 via the capacitor 44 to the amplifier 41, causing this circuit to oscillate.

[0016] However, the above-described oscillation circuit shown in Fig. 3 performs an unbalanced operation. As a result, in order to suppress leakage of the oscillation signal (spurious signal), a power terminal T_3 must be grounded in a high-frequency manner by the capacitor 8 so as to decrease the impedance thereof and stabilize the circuit. Also, it is necessary to strictly shield the entire oscillation circuit. Furthermore, there are problems, for example, since the degree of balance is poor, loopback of signals occurs, and therefore in order to stably generate a signal of a predetermined frequency without being affected by temperature change or aging, an adjustment operation is indispensable.

[0017] Meanwhile, since the oscillation circuit shown in Fig. 6 also performs an unbalanced operation, countermeasures for factors which obstruct the formation of ICs of a small size and integration of ICs must be performed, for example, independent power terminals are provided to make high-frequency grounding easy, or the number of parallel grounding terminals is increased. As a result, only signals of a frequency of, for example, 100 MHz, can be generated, and there is a problem in that it is difficult to stably generate a signal of a frequency higher than that frequency without being affected by temperature change or aging.

[0018] US 3,787,612 discloses an oscillation circuit including a one-port SAW resonator in which the output of one of a pair of transistors is fed back to the input of the other.

[0019] The present invention has been achieved in view of such circumstances and aims to stably generate a signal of a higher frequency.

[0020] The oscillation circuit according to the invention is defined in claim 1.

[0021] The oscillation method according to the invention is defined in claim 13.

[0022] The above and further objects, aspects and novel features of the invention will become more apparent from the following detailed description when read in connection with the accompanying drawings, in which:

Fig. 1 is a circuit diagram illustrating the construction of an embodiment of an oscillation circuit of the present invention;
Fig. 2 is a circuit diagram illustrating the construction of another embodiment of the oscillation circuit of the present invention;
Fig. 3 is a circuit diagram illustrating the construction of the oscillation circuit;
Fig. 4 shows the construction of a one-port-type SAW resonator;
Fig. 5 is a circuit diagram illustrating an equivalent circuit of the example of Fig. 4;
Fig. 6 is a circuit diagram illustrating an example of the construction of another oscillation circuit;
Fig. 7 shows the construction of a two-port-type SAW resonator; and
Fig. 8 is a circuit diagram illustrating an equivalent circuit of the example of Fig. 7.

[0023] Fig. 1 is a circuit diagram illustrating the construction of an embodiment of an oscillation circuit of the present invention (however, the illustration of the biases of the transistors 61 and 62 are omitted). In this embodiment, the emitters of NPN transistors 61 and 62 serving as bipolar transistors are connected in common, with the common connection point being grounded via a constant-current circuit 63. The collector of the NPN transistor 61 is connected to a power terminal 70 via a load impedance 64, and the collector of the NPN transistor 62 is connected to the power terminal 70 via a load impedance 65. That is, the NPN transistor 61 and the NPN transistor are differentially connected to form a differential amplifier.

[0024] Also, the collector of the NPN transistor 61 is connected to the base of the NPN transistor 62 via a capacitor 67, and the collector of the NPN transistor 62 is connected to the base of the NPN transistor 61 via a capacitor 66. That is, one of the outputs of the differentially connected NPN transistors 61 and 62 is positively fed back to the input of the other transistor. The capacitors 66 and 67 form a positive feedback circuit for this purpose.

[0025] Further, the collectors of the NPN transistors 61 and 62 are connected to the terminals T_1 and T_2 of the one-port-type SAW resonator 9 via capacitors 68 and 69 for blocking the flow of direct current, respectively. The one-port-type SAW resonator 9, as described above, is formed in such a shape as that shown in Fig. 4, and the equivalent circuit thereof is formed as shown in Fig. 5.

[0026] The output of the collector of the NPN transistor 61 is positively fed back to the base of the NPN transistor 62 via the capacitor 67. Also, the output of the collector of the NPN transistor 62 is positively fed back to the base of the NPN transistor 61 via a capacitor 66. As a result, this oscillation circuit substantially oscillates in a parallel resonance mode defined substantially by the values (C_{24} and L_{22}) of the capacitor 24 and the coil 22 of the one-port-type SAW resonator 9.

[0027] When it is assumed that the parameters of the NPN transistors 61 and 62 are the same, the values of the load impedances 64 and 65 are equal to each other, the values of the capacitors 68 and 69 are equal to each other, and the values of the capacitors 66 and 67 are equal to each other ($Z_{64} = Z_{65}$, $C_{68} = C_{69}$, and $C_{66} = C_{67}$), and this oscillation circuit reaches a completely balanced state. Since a completely balanced state is reached, in the power terminal 70 and the emitters of the NPN transistors 61 and 62, the opposite-phase amplitude components are canceled with each other, and they reach a virtually grounded state. Therefore, an oscillation circuit which does not require a high-frequency grounding terminal for suppressing a spurious signal and having a small amount of leakage can be realized.

[0028] Also, since a completely balanced circuit is formed, adjustments are not required, and an oscillation operation can be performed stably and with a high degree of accuracy regardless of temperature change or aging.

[0029] For example, it is required that the second intermediate frequency signal in a digital television broadcast have a high frequency of 480 MHz, and its accuracy be in the range of ±100 kHz. According to the embodiment of Fig. 1, it is possible to generate such high-frequency signal with the required accuracy and without adjustments.

[0030] When the circuit shown in Fig. 5 is formed from parts of discrete resistors, coils and capacitors in place of the one-port-type SAW resonator 9, the circuit is affected by temperature change, ageing or the like, and it becomes difficult to generate a high-frequency signal with a high degree of accuracy. Therefore, it becomes necessary to use a one-port-type SAW resonator.

[0031] Fig. 2 shows the construction of a second embodiment of an oscillation circuit of the present invention. In this embodiment, the collector of an NPN transistor 81 is connected to a power terminal 91, and the emitter thereof is connected to a constant-power source 85. Further, the collector of an NPN transistor 82 is also connected to the power terminal 91, and the emitter thereof is connected to a constant-power source 86. Furthermore, the emitters of the NPN transistors 81 and 82 are connected to each other via a capacitor 87, and thus these transistors form a differential amplifier.

[0032] Further, in this embodiment, the signal output from the emitter of the NPN transistor 81 is positively fed back to the base of the NPN transistor 81 via a capacitor 83, and the signal output from the emitter of the NPN transistor 82 is positively fed back to the base of the NPN transistor 82 via a capacitor 84. Furthermore, terminals T_1 and T_2 of the one-port-type SAW resonator 9 are connected between the bases of the NPN transistors 81 and 82 via the capacitors 88 and 89 for blocking the flow of direct current, respectively.

[0033] In this embodiment also, the capacitances of the capacitors 88 and 89 are equal to each other, and the capacitances of the capacitors 83 and 84 are equal to each other ($C_{88} = C_{89}$, and $C_{83} = C_{84}$), and if the parameters of the constant-current sources 85 and 86, and the NPN transistors 81 and 82 are made to be the same, a completely balanced state is reached, and oscillation amplitude does not occur in the collectors of the NPN transistors 81 and 82. Therefore, in this case, a capacitor 90 (functions in the same way as the capacitor 8 in Fig. 3) for grounding a power terminal 91, such as that shown in Fig. 2, is not required.

[0034] In this embodiment also, by using a differential amplifier and a one-port-type SAW resonator and by using elements having the same parameters as those of the first embodiment, a completely balanced condition is set. Thus, it becomes possible to generate a high-frequency signal without adjustments and with a high degree of accuracy.

[0035] These oscillation circuits are suitable for a case in which they are contained in a high-frequency IC. When, in particular, the impedance to the power source and the grounding conductor cannot be sufficiently lowered, the oscillation circuits may be used in a case in which a high-frequency signal is generated with a high degree of accuracy and without adjustments.

[0036] Although in the above-described embodiment an NPN transistor is used as an active element which constitutes a differential amplifier, it is also possible to use a PNP transistor or an FET.

[0037] As has been described up to this point, according to the oscillation circuit described in claim 1 and the oscillation method described in claim 13, since the output of the differential amplifier is positively fed back to its input, and a one-port-type SAW resonator connected between a pair of active elements is caused to perform an oscillation operation, it becomes possible to generate a high-frequency signal without adjustments and with a high degree of accuracy without being affected by temperature change and ageing. Therefore, the present invention may be applied to, for example, a case in which a second intermediate frequency signal of a digital broadcast satellite is generated.

[0038] Many different embodiments of the present invention may be constructed without departing from the spirit and scope of the present invention. It should be understood that the present invention is not limited to the specific embodiments described in this specification. To the contrary, the present invention is intended to cover various modifications and equivalent arrangements included within the scope of the invention as hereafter claimed. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications, equivalent structures and functions.

Claims

1. An oscillation circuit for generating a high-frequency signal, said oscillation circuit comprising:

   a differential amplifier having at least a pair of active elements (61, 62; 81, 82) which are differentially connected;
   a positive feedback circuit (66, 67; 83, 84) for positively feeding back the output of said differential amplifier to the input thereof; and
   a one-port SAW resonator (9) connected between said pair of active elements; **characterised in that**
   in said feedback circuit (66, 67; 83, 84) the output of each of said at least a pair of active elements (61, 62; 81, 82) is fed back to a different input of said at least a pair of active elements.

2. An oscillation circuit according to claim 1, wherein said active elements are bipolar transistors (61, 62; 81, 82).

3. An oscillation circuit according to claim 2, wherein said one-port SAW resonator (9) is connected between the collectors of a pair of said bipolar transistors (61, 62).

4. An oscillation circuit according to claim 3, wherein said one-port SAW resonator (9) is connected between the collectors of said pair of bipolar transistors (61, 62) via separate capacitors (68, 69) for blocking the flow of direct current.

5. An oscillation circuit according to claim 3 or 4, wherein said positive feedback circuit comprises a first capacitor (66) which connects the collector of a first bipolar transistor (62) which forms part of said differential amplifier to the base of a second bipolar transistor (61) which forms part of said differential amplifier; and

   a second capacitor (67) which connects the collector of said second bipolar transistor (61) to the base of said first bipolar transistor (62).

6. An oscillation circuit according to any one of claims 3 to 5 wherein the collectors of said pair of bipolar transistor (61, 62) are each connected to a power source (70) via a pair of load impedances (64, 65),

and the emitters of said pair of bipolar transistors (61, 62) are connected in common, with the common connection point being grounded via a constant-current circuit (63).

7. An oscillation circuit according to claim 3, wherein said one-port SAW resonator (9) is connected between the collectors of a pair of said bipolar transistors (61, 62) via separate capacitors (68, 69) for blocking the flow of direct current,

said positive feedback circuit includes a pair of capacitors (66, 67) for positive feedback through which the collectors of said pair of bipolar transistors (61, 62) are connected to the bases of the other transistors (61, 62),

the collectors of said pair of bipolar transistors (61, 62) are each connected to a power source (70) via a pair of load impedances (64, 65), and

the capacitances of said pair of capacitors (68, 69) for blocking the flow of direct current are made to be equal to each other, the capacitances of said pair of capacitors (66, 67) for positive feedback are made to be equal to each other, and the impedances of said pair of load impedances (64, 65) are made to be equal to each other.

8. An oscillation circuit according to claim 2, wherein said one-port SAW resonator (9) is connected between the bases of said bipolar transistors (81, 82).

9. An oscillation circuit according to claim 8, wherein said one-port SAW resonator (9) is connected between the bases of said pair of said bipolar transistors (81, 82) via separate capacitors (88, 89) for blocking the flow of direct current.

10. An oscillation circuit according to claim 8, wherein said positive feedback circuit includes a first capacitor (83) which connects the emitter of a first bipolar transistor (81) which forms part of said differential amplifier to the base of said first bipolar transistor (81); and

a second capacitor (84) which connects the emitter of a second bipolar transistor (82) which forms part of said differential amplifier to the base of said second bipolar transistor (82).

11. An oscillation circuit according to claim 8, 9 or 10 wherein the collectors of said pair of bipolar transistors (81, 82) are connected in common, with the common connection point being connected to a power source (91), and the emitters of said pair of bipolar transistors (81, 82) are grounded, each via a constant-current circuit (85, 86).

12. An oscillation circuit according to claim 8, wherein said one-port SAW resonator (9) is connected between the bases of said pair of bipolar transistors (81, 82) via separate capacitors (88, 89) for blocking the flow of direct current,

said positive feedback circuit includes a pair of capacitors (83, 84) for positive feedback, each of which capacitors (83, 84) connects the emitter of one of said pair of bipolar transistors (81, 82) to the base of the same transistor (81, 82), and

the capacitances of said capacitors (88, 89) for blocking the flow of direct current are made to be equal to each other, and the capacitances of said capacitors (83, 84) for positive feedback are made to be equal to each other.

13. An oscillation method for generating a high-frequency signal, said method comprising the steps of:

positively feeding back the output of a differential amplifier having at least a pair of active elements (61, 62; 81, 82) which are differentially connected to the input thereof; and
causing a one-port SAW resonator connected between said pair of active elements (61, 62; 81, 82) to perform an oscillation operation; **characterised in that**
in said feeding back step the output of each of said at least a pair of active elements (61, 62; 81, 82) is fed back to a different input of said at least a pair of active elements.

14. An oscillation method according to claim 13, wherein the output from said pair of active elements (61, 62; 81, 82) is input to said one-port SAW resonator (9) after the direct current components are removed.

15. An oscillation method according to claim 14, wherein said positive feedback is performed in such a way that the output from the collector of a first bipolar transistor (62) which forms part of said differential amplifier is fed back to the base of a second bipolar transistor (61) which forms part of said differential amplifier via a first capacitor (66), and that the output from the collector of said second bipolar transistor (61) is fed back to the base of the first bipolar transistor (62) via a second capacitor(67).

16. An oscillation method according to claim 14, wherein said positive feedback is performed in such a way that the output from the emitter of a first bipolar transistor (81) which forms part of said differential amplifier is fed back to the base of the first bipolar transistor (81) via a first capacitor (83), and that the output from the emitter of a second bipolar transistor (82) which forms part os said differential amplifier is fed back to the base of the second bipolar transistor (82) via a second capacitor (84).

Revendications

1. Circuit d'oscillation pour générer un signal haute-fréquence, ledit circuit d'oscillation comprenant :

   un amplificateur différentiel ayant au moins une paire d'éléments actifs (61, 62 ; B1, B2) qui sont différentiellement raccordés ;
   un circuit de rétroaction positif (66, 67 ; 83, 84) pour renvoyer positivement la sortie dudit amplificateur différentiel à l'entrée de celui-ci ; et
   un résonateur SAW à un port (9) raccordé entre ladite paire d'éléments actifs ; **caractérisé en ce que**
   dans ledit circuit de rétroaction (66, 67 ; 83, 84) la sortie de chacune d'au moins une dite paire d'éléments actifs (61, 62 ; 81, 82) soit renvoyée à l'entrée différente d'au moins une dite paire d'éléments actifs.

2. Circuit d'oscillation selon la revendication 1, dans lequel lesdits éléments actifs sont des transistors bipolaires (61, 62 ; 81, 82).

3. Circuit d'oscillation selon la revendication 2, dans lequel ledit résonateur SAW à un port (9) est raccordé entre les collecteurs d'une paire desdits transistors bipolaires (61, 62).

4. Circuit d'oscillation selon la revendication 3, dans lequel ledit résonateur SAW à un port (9) est raccordé entre les connecteurs de ladite paire de transistors bipolaires (61, 62) via des condensateurs séparés (68, 69) pour bloquer le flux de courant continu.

5. Circuit d'oscillation selon la revendication 3 ou 4, dans lequel ledit circuit de rétroaction positif comprend un premier condensateur (66) qui relie le collecteur d'un premier transistor bipolaire (62) qui forme une partie dudit amplificateur différentiel à la base dudit second transistor bipolaire (61) qui formé une partie dudit amplificateur différentiel ; et
   un second condensateur (67) qui relie le collecteur dudit second transistor bipolaire (61) à la base dudit premier transistor bipolaire (62).

6. Circuit d'oscillation selon l'une quelconque des revendications 3 à 5 dans lequel les collecteurs de ladite paire de transistors bipolaires (61, 62) sont chacun raccordés à une source d'alimentation (70) via une paire d'impédances de charge (64, 65), et les émetteurs de ladite paire de transistors bipolaires (61, 62) sont montés en commun, avec le point de raccordement commun étant mis à la masse via un circuit de courant constant (63).

7. Circuit d'oscillation selon la revendication 3, dans lequel ledit résonateur SAW à un port (9) est raccordé entre les collecteurs d'une paire desdits transistors bipolaires (61, 62) via des condensateurs séparés (68, 69) pour bloquer le flux de courant continu,
   ledit circuit de rétroaction positif comprend une paire de condensateurs (66, 67) pour une rétroaction positive à travers laquelle les collecteurs de ladite paire de transistors bipolaires (61, 62) sont raccordés aux bases des autres transistors (61, 62),
   les collecteurs de ladite paire de transistors bipolaires (61, 62) sont chacun raccordé à une source d'alimentation (70) via une paire d'impédances de charge (64, 65), et
   les capacitances de ladite paire de condensateurs (68, 69) pour bloquer le flux de courant continu sont faites pour être égales l'une à l'autre, les capacitances de ladite paire de condensateurs (66, 67) pour une rétroaction positive sont faites pour être égales l'une à l'autre, et les impédances de ladite paire d'impédances de charge (64, 65) sont faites pour être égales l'une à l'autre.

8. Circuit d'oscillation selon la revendication 2, dans lequel ledit résonateur SAW à un port (9) est raccordé entre les bases desdits transistors bipolaires (81, 82).

9. Circuit d'oscillation selon la revendication 8, dans lequel ledit résonateur SAW à un port (9) est raccordé entre les bases de ladite paire desdits transistors bipolaires (81, 82) via des condensateurs séparés (88, 89) pour bloquer le flux de courant continu.

10. Circuit d'oscillation selon la revendication 8, dans lequel ledit circuit de rétroaction positif comprend un premier condensateur (83) qui relie l'émetteur d'un premier transistor bipolaire (81) qui forme une partie dudit amplificateur différentiel à la base dudit premier transistor bipolaire (81) ; et
    un second condensateur (84) qui relie l'émetteur du second transistor bipolaire (82) qui forme une partie dudit amplificateur différentiel à la base dudit second transistor bipolaire (82).

11. Circuit d'oscillation selon la revendication 8, 9 ou 10 dans lequel les collecteurs de ladite paire de transistors bipolaires (81, 82) sont raccordés en commun, avec le point de connexion commun étant raccordé à une source d'alimentation (91), et les émetteurs de ladite paire de transistors bipolaires (81, 82) sont mis à la masse, chacun via un circuit de courant constant (85, 86).

12. Circuit d'oscillation selon la revendication 8, dans lequel ledit résonateur SAW à un port (9) est rac-

cordé entre les bases de ladite paire de transistors bipolaires (81, 82) via des condensateurs séparés (88, 89) pour bloquer le flux de courant continu,

ledit circuit de rétroaction positive comprend une paire de condensateurs (83, 84) pour une rétroaction positive, dont chacun des condensateurs (83, 84) relie l'émetteur à un de ladite paire de transistors bipolaires (81, 82) à la base du même transistor (81, 82), et

les capacitances desdits condensateurs (88, 89) pour bloquer le flux de courant continu sont rendues égales l'une à l'autre, et les capacitances desdits condensateurs (83, 84) pour une rétroaction positive sont faites pour être égales l'une à l'autre.

13. Procédé d'oscillation pour générer un signal haute-fréquence, ledit procédé comprenant les étapes de :

rétroaction positive de la sortie d'un amplificateur différentiel ayant au moins une paire d'éléments actifs (61, 62 ; 81, 82) qui sont differentiellement raccordés à l'entrée de celui-ci ; et raccordement d'un résonateur SAW à un port entre ladite paire d'éléments actifs (61, 62 ; 81, 82) pour réaliser une opération d'oscillation ; **caractérisé en ce que**
dans ladite étape de rétroaction la sortie de chacun d'au moins une dite paire d'éléments actifs (61, 62 ; 81, 82) est renvoyée à une entrée différente d'au moins une dite paire d'éléments actifs.

14. Procédé d'oscillation selon la revendication 13, dans lequel la sortie de ladite paire d'éléments actifs (61, 62 ; 81, 82) est appliquée audit résonateur SAW à un port (9) après que la composante de courant continu soit enlevée.

15. Procédé d'oscillation selon la revendication 14, dans lequel ladite rétroaction positive est réalisée de manière à ce que la sortie du collecteur d'un premier transistor bipolaire (62) qui forme une partie dudit amplificateur différentiel est renvoyée à la base dudit second transistor bipolaire (61) qui forme une partie dudit amplificateur différentiel via un premier condensateur (66), et en ce que la sortie du collecteur dudit second transistor bipolaire (61) est renvoyée à la base du premier transistor bipolaire (62) via un second condensateur (67).

16. Procédé d'oscillation selon la revendication 14, dans lequel ladite rétroaction positive est réalisée de manière à ce que la sortie de l'émetteur d'un premier transistor bipolaire (81) qui forme une partie dudit amplificateur différentiel soit renvoyée à la base dudit premier transistor bipolaire (81) via un premier condensateur (83), et en ce que la sortie de l'émetteur d'un second transistor bipolaire (82) qui forme une partie dudit amplificateur différentiel est renvoyée à la base du second transistor bipolaire (82) via un second condensateur (84).

Patentansprüche

1. Oszillatorschaltung zum Erzeugen eines Hochfrequenzsignals, wobei die Oszillatorschaltung aufweist:

einen Differenzverstärker, der zumindest zwei aktive Elemente (61, 62; 81, 82) aufweist, die differentiell geschaltet sind;
eine Spannungsmitkopplungsschaltung (66, 67; 83, 84) zur Spannungsmitkopplung des Ausgangs des Differenzverstärkers zu dessen Eingang; und
einen Ein-Port-SAW-Resonator (9), der zwischen den beiden aktiven Elementen geschaltet ist; **dadurch gekennzeichnet, dass**
in der Rückkopplungsschaltung (66, 67; 83, 84) das Ausgangssignal von jedem der zumindest beiden aktiven Elemente (61, 62; 81, 82) zu einem unterschiedlichen Eingangsanschluss der zumindest beiden aktiven Elemente zurückgeführt wird

2. Oszillatorschaltung nach Anspruch 1, wobei die aktiven Elemente Bipolar-Transistoren (61, 62; 81, 82) sind.

3. Oszillatorschaltung nach Anspruch 2, wobei der Ein-Port-SAW-Resonator (9) zwischen den Kollektoren von zwei Bipolar-Transistoren (61, 62) geschaltet ist.

4. Oszillatorschaltung nach Anspruch 3, wobei der Ein-Port-SAW-Resonator (9) zwischen den Kollektoren der beiden Bipolar-Transistoren (61, 62) über separate Kondensatoren (68, 69) geschaltet ist, um den Gleichstromfluss zu blockieren.

5. Oszillatorschaltung nach Anspruch 3 oder 4, wobei die Spannungsmitführungsschaltung einen ersten Kondensator (66) aufweist, der den Kollektor eines ersten Bipolar-Transistors (62), der Teil des Differenzverstärkers ist, mit der Basis des zweiten Bipolar-Transistors (61) verbindet, der Teil des Differenzverstärkers ist; und

einen zweiten Kondensator (67), der den Kollektor des zweiten Bipolar-Transistors (61) mit der Basis des ersten Bipolar-Transistors (62) verbindet.

6. Oszillatorschaltung nach einem der Ansprüche 3 bis 5, wobei die Kollektoren der beiden Bipolar-Transistoren (61, 62) jeweils mit einer Spannungs-

quelle (70) über zwei Lastimpedanzen (64, 65) verbunden sind, und die Emitter der beiden Bipolar-Transistoren (61, 62) miteinander verbunden sind, wobei der gemeinsame Verbindungspunkt über eine Konstantstromschaltung (63) geerdet ist.

7. Oszillatorschaltung nach Anspruch 3, wobei der Ein-Port-SAW-Resonator (9) zwischen den Kollektoren von zwei Bipolar-Transistoren (61, 62) über separate Kondensatoren (68, 69) geschaltet ist, um den Gleichstromfluss zu blockieren,

die Spannungsmitkopplungsschaltung zwei Kondensatoren (66, 67) für Spannungsmitkopplung aulweist, über die die Kollektoren der beiden Bipolar-Transistoren (61, 62) mit den Basisanschlüssen der anderen Transistoren (61, 62) verbunden sind,

die Kollektoren der beiden Bipolar-Transistoren (61, 62) jeweils mit einer Spannungsquelle (70) über ein Lastimpedanzpaar (64, 65) verbunden sind, und

die Kapazitäten der beiden Kondensatoren (68, 69) zum Blockieren des Gleichstromflusses so ausgeführt sind, dass sie einander gleich sind, die Kapazitäten der beiden Kondensatoren (66, 67) zur Spannungsmitkopplung so ausgeführt sind, dass sie einander gleich sind, und die Impedanzen der beiden Lastimpedanzen (64, 65) so ausgeführt sind, dass sie einander gleich sind.

8. Oszillatorschaltung nach Anspruch 2, wobei der Ein-Port-SAW-Resonator (9) zwischen den Basisanschlüssen der Bipolar-Transistoren (82,82) geschaltet ist.

9. Oszillatorschaltung nach Anspruch 8, wobei der Ein-Port-SAW-Resonator (9) zwischen den Basisanschlüssen der beiden Bipolar-Transistoren (81, 82) über separate Kondensatoren (88, 89) geschaltet ist, um den Gleichstromfluß zu blockieren.

10. Oszillatorschaltung nach Anspruch 8, wobei die Spannungsmitkopplungsschaltung einen ersten Kondensator (83) aufweist, der den Emitter eines ersten Bipolar-Transistors (81), der Teil des Differenzverstärkers ist, mit der Basis des ersten Bipolar-Transistors (81) verbindet; und

einen zweiten Kondensator (84), der den Emitter eines zweiten Bipolar-Transistors (82), der Teil des Differenzverstärkers ist, mit der Basis des zweiten Bipolar-Transistors (82) verbindet.

11. Oszillatorschaltung nach Anspruch 8, 9 oder 10, wobei die Kollektoren der beiden Bipolar-Transistoren (81, 82) miteinander verbunden sind, wobei der gemeinsame Verbindungspunkt mit einer Spannungsquelle (91) verbunden ist, und die Emitter der beiden Bipolar-Transistoren (81, 82) jeweils über eine Konstantstromschaltung (85, 86) geerdet sind.

12. Oszillatorschaltung nach Anspruch 8, wobei der Ein-Port-SAW-Resonator (9) zwischen den Basisanschlüssen der beiden Bipolartransistoren (81, 82) über separate Kondensatoren (88, 89) geschaltet ist, um den Gleichstromfluß zu blockieren,

die Spannungsmitkopplungsschaltung zwei Kondensatoren (83, 84) zur Spannungsmitkopplung aufweist, wobei jeder der Kondensatoren (83, 84) den Emitter eines der beiden Bipolar-Transistorpaare (81, 82) mit der Basis des gleichen Transistors (81, 82) verbindet, und

die Kapazitäten des Kondensatoren (88, 89) zum Blockieren der Gleichstromflusses so ausgeführt sind, dass sie einander gleich sind, und die Kapazitäten der Kondensatoren (83, 84) zur Spannungsmitkopplung so ausgeführt sind, dass sie einander gleich sind.

13. Oszillatorverfahren zum Erzeugen eines Hochfrequenzsignals, wobei das Verfahren folgende Schritte aufweist:

Spannungsmitkoppeln des Ausgangssignals eines Differenzverstärkers, der zumindest zwei aktive Elemente (61, 62; 81, 82) aufweist, die differentiell mit dessen Eingangsanschluss verbunden sind; und

Veranlassen, dass ein Ein-Port-SAW- Resonator, der zwischen den beiden aktiven Elementen (61, 62; 81, 82) geschaltet ist, einen Oszillatorbetrieb ausführt, **dadurch gekennzeichnet, dass**

im Rückkopplungsschritt das Ausgangssignal eines jeden des von zumindest zwei aktiven Elementen (61, 62; 81, 82) zu einem unterschiedlichen Eingang von zumindest zwei aktiven Elementen geführt wird.

14. Oszillatorverfahren nach Anspruch 13, wobei das Ausgangssignal von den beiden aktiven Elementen (61, 62; 81, 82) zum Ein-Port-SAW-Resonator (9) geliefert wird, nachdem die Gleichstromkomponenten beseitigt sind.

15. Oszillatorverfahren nach Anspruch 14, wobei die Spannungsmitkopplung in einer Weise durchgeführt wird, dass das Ausgangssignal vom Kollektor eines Bipolar-Transistors (62), der Teil des Differenzverstärkers ist, zur Basis eines zweiten Bipolartransistors (61), der Teil des Differenzverstärkers bildet, über einen ersten Kondensator (66) zurückgeführt wird, und dass das Ausgangssignal vom Kollektor des zweiten Bipolartransistors (61) zur Basis des ersten Bipolar-Transistors (62) über einen zweiten Kondensator (67) zurückgeführt wird.

16. Oszillatorverfahren nach Anspruch 14, wobei die Spannungsmitkopplung in einer Weise durchge-

führt wird, dass das Ausgangssignal vom Emitter eines ersten Bipolar-Transistors (81), der Teil des Differenzverstärkers ist, zur Basis des ersten Bipolar-Transistors (81) über einen ersten Kondensator (83) zurückgeführt wird, und dass das Ausgangssignal vom Emitter des zweiten Bipolar-Transistors (839, der Teil des zweiten Differenzverstärkers ist, zur Basis des zweiten Bipolar-Transistors (82) über einen zweiten Kondensator (84) geführt wird.

FIG. 1

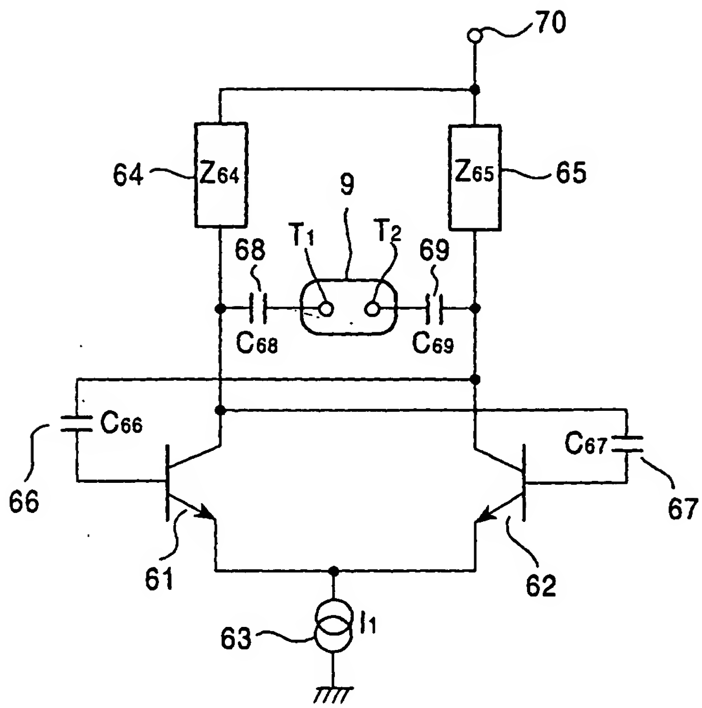
70
64
Z64
Z65
65
9
T1
T2
68
69
C68
C69
C66
C67
66
67
61
62
63
I1

FIG. 2

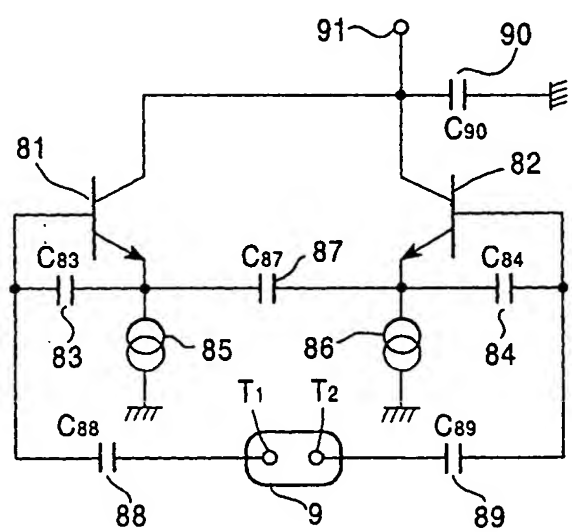
91
90
C90
81
82
C83
C87
87
C84
83
85
86
84
T1
T2
C88
C89
88
9
89

FIG. 3

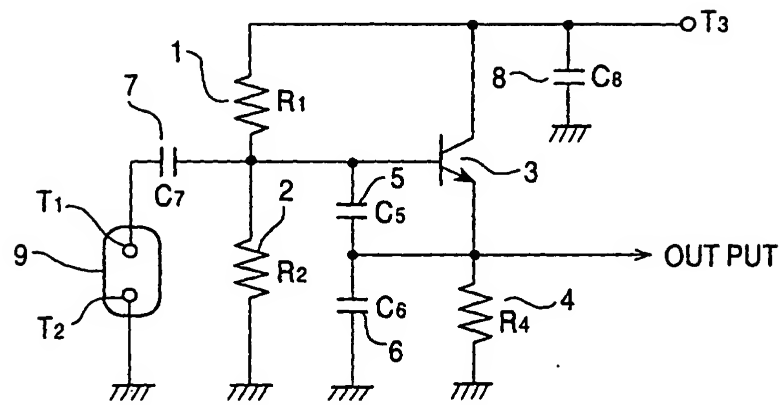

FIG. 4

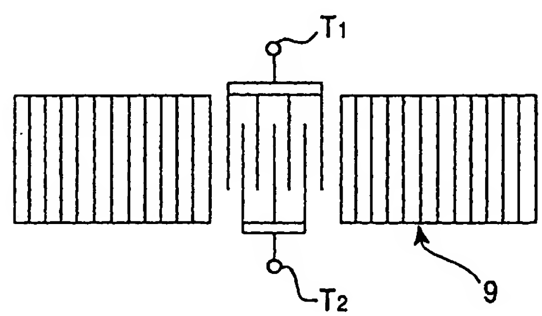

FIG. 5

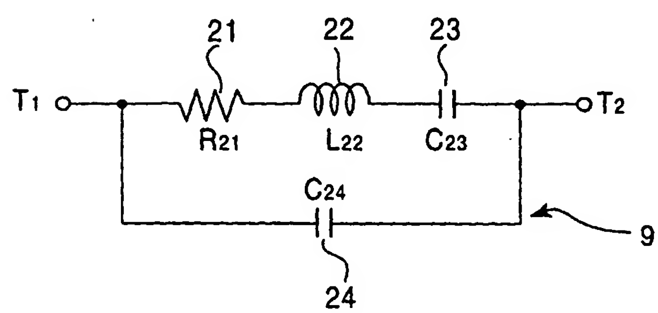

FIG. 6

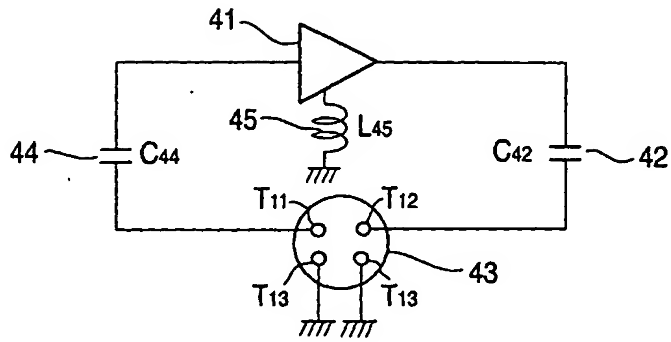

FIG. 7

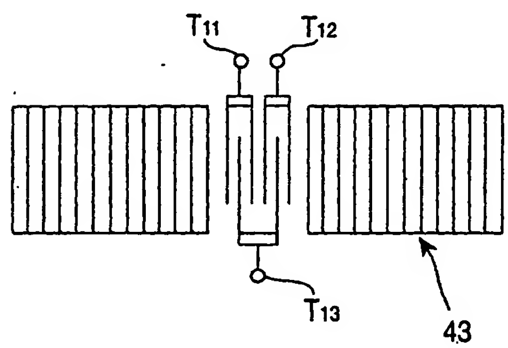

FIG. 8